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PCT/ZA2003/000160

Inventors: Richard George PAXTON et al.

Attorney Docket No. 02814.0076

**ANNEXES TO THE  
PRELIMINARY EXAMINATION REPORT  
(ARTICLE 34 AMENDMENTS)**

**MAIL STOP PCT**

**Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450**

Sir:


**REQUEST FOR SUBSTITUTION OF REPLACEMENT SHEETS**

Please substitute the attached replacement sheets 100-101, 108-111a of the Article 34 Amendments for sheets 100-101, 108-111 of the specification in the enclosed as-filed PCT application. It is respectfully requested that the claims in the substitute sheets be examined during examination of the patent application. Claims 1-59 are currently pending.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,  
GARRETT & DUNNER, L.L.P.

Dated: April 29, 2005

By:   
Ernest F. Chapman  
Reg. No. 25,961

EFC/FPD/blc

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 03 FEB 2005



WIPO PCT

Applicant's or agent's file reference P25575PC00		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/ZA 03/00160	International filing date (day/month/year) 29.10.2003	Priority date (day/month/year) 29.10.2002	
International Patent Classification (IPC) or both national classification and IPC B01J19/24			
Applicant ISCOR LIMITED et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
  - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☒ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain documents cited
  - VII ☐ Certain defects in the international application
  - VIII ☐ Certain observations on the international application

Date of submission of the demand  05.05.2004	Date of completion of this report  02.02.2005
Name and mailing address of the International preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Thomasson, P  Telephone No. +49 89 2399-8339 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/ZA 03/00160**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-99 as originally filed

**Claims, Numbers**

9-38 as originally filed

1-8, 39-59 filed with telefax on 17.01.2005

**Drawings, Sheets**

1/34-34/34 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/ZA 03/00160**

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

**see separate sheet**

6. Additional observations, if necessary:

**IV. Lack of unity of invention**

1. In response to the invitation to restrict or pay additional fees, the applicant has:

- ☐ restricted the claims.  
☒ paid additional fees.  
☐ paid additional fees under protest.  
☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.  
☒ not complied with for the following reasons:

**see separate sheet**

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.  
☐ the parts relating to claims Nos. .

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-47
	No: Claims	48-56
Inventive step (IS)	Yes: Claims	1-47
	No: Claims	48-56
Industrial applicability (IA)	Yes: Claims	1-56
	No: Claims	

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**2. Citations and explanations**

**see separate sheet**

**Re Item I**

**Basis of the report**

The present application does not meet the requirement of Article 34(2)(b) PCT for the following reasons:

1. Originally claims 1 and 42, which met the clarity requirements of Article 6 PCT as well as the novelty and inventive step requirements of Article 33(2)-(3) PCT, have been substantially amended.

Some of the features which were explicitly indicated in the originally filed claims 1 and 42, e. g. the presence of "a point of inflexion", are now missing.

Some other features, like "an outside surface and an inside surface between the outside surface and the centre of curvature..." have been added. To this regard it is not clear which passages of the description provide a support for the amended features introduced into claims 1 and 42. Therefore claims 1 and 42, but also claims 2-41 (dependent claims) are considered as introducing subject-matter which extends beyond the content of the application as filed.

**Consequently this report has been established for the originally filed claims 1-41 and 42.**

2. Claims 48 and 49 indicate a composite material with two groups of SiC particles, the particles of the first group are dimensionally **at least 7.5 times larger** than the particles of the second group. This feature is not supported by the originally filed application. In particular the description on pages 57-65, especially on page 64, lines 4-19, which discloses in more details the plastic composite, does not disclose such a feature.

Therefore claims 48 and 49, and consequently claims 50-57 (dependent claims) and claims 58-59 are considered as introducing subject-matter which extends beyond the content of the application as filed.

**Consequently this report has been established for originally filed claims 48-56.**

**Re Item IV**

**Lack of unity of invention**

The present application does not meet the requirement of **Unity of invention** (Rule 13.1 PCT) for the following reasons, the separate inventions being:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/ZA 03/00160

**1. Claims: 1-47**

- An apparatus and the corresponding method for the removal of fine particles from a fluid, the apparatus comprising a curved flow path with some edges within the flow path,

**2. Claims: 48-56**

- A plastic material comprising an abrasion resistant composite.

There is no **single general concept** at all linking the subject-matters of the above groups of claims. The subject-matter of claims 48-56 is solely a plastic material. Claims 48-56 do not mention any curved flow path with edges. The fact that the plastic material is for the manufacture of the apparatus of claim 1 does not create any link between the subject-matter of claim 1 (and claim 42) and the subject-matter of claim 48. Thus in the absence of any common special technical features between the subject-matters of independent claims 1 (and 42) and 48 (Rule 13.2 PCT), the present application does not meet the unity requirement of Rule 13.1 PCT.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Reference is made to the following documents:

D2: US-A-4 551 496 (RENLUND GARY M ET AL) 5 November 1985 (1985-11-05)

D3: DE 100 36 499 A (NOMIG GMBH) 8 February 2001 (2001-02-08)

D4: GB 942 756 A (KALLE AG) 27 November 1963 (1963-11-27)

D5: DE 24 57 446 A (METZELER KAUTSCHUK) 10 June 1976 (1976-06-10)

2. Claims 1-47 **meet** the requirements of Article 33(2)-(3) PCT:

2.1 Closest prior art.

D1 (WO94/29017), cited in the present application as US-A-5 741 466, discloses an apparatus and the corresponding method for mixing fluids comprising a **curved flow path** (see D1: International Search Report and figure 1a).

2.2 Novelty.

The subject-matter of claims 1 and 42 differs from D1 in that it indicates an **edge formation** within the curved flow path.

2.3 Inventive step.

The technical problem to be solved against D1 is to improve the transfer of some solid particles from a first fluid into a second fluid. The subject-matter of claims 1 and 42 allows, due to the presence of the edge formation, to better mix the two fluids, which solves the above technical problem (see the present application: page 4, lines 7-10 and page 4, line 23 - page 6, line 2). D1 discloses either a curved flow path **without any edges** (see § 1.1 above) or a "zig-zag" flow path **without any curved part** and without any point of inflexion (see D1: figure 7). Furthermore D1 teaches explicitly not in favour from using such a "zig-zag" flow path since it creates undesired turbulences (see D1: page 14, lines 16-36). Therefore the skilled person **would not** include some edges within the curved flow path disclosed in D1, figure 1a. An inventive step can therefore be recognized.

3. Claims 48-56 **do not meet** the requirement of Article 33(2) PCT:

- 3.1 D2-D4 disclose a plastic material suitable for the manufacture of equipment of claim 1 which comprises a **SiC** filler and a **vinyl ester** resin (see D2-D4: International Search Report). Therefore the subject-matter of claim 1 is not novel.
- 3.2 The technical features of claims 49-56 are either known from D2-D5 (D5: silanation of SiC, see D5: International Search Report) or are considered to be merely one of several possibilities which the skilled person would select, in accordance with the circumstances, without the exercise of inventive skill. Consequently these claims do not meet the requirement of Article 33(3) PCT.

**Additional observations**

1. Claim 48 is not clear since it is unclear from the wording of this claim if the abrasion resistant composite is one of a filler, SiC or a vinyl ester resin or if the three listed compounds (filler, SiC, vinyl ester resin) are **all presents** in the plastic material claimed.



2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D2-D4 is not mentioned in the description, nor are these documents identified therein.

CLAIMS

1. Equipment for use in the removal of at least one of relatively fine particulates and components from a first substance, using a second substance, the equipment including a static, co-current contacting mixer section having a plurality of stages defining a flow path, with a flow profile, for the first and the second substance, at least one stage being shaped to define a substantially curved flow path section having an effective centre of curvature located to one side of the flow path, an outside surface and an inside surface between the outside surface and the centre of curvature; at least one immediately adjacent stage being shaped to define an oppositely curved flow path section having a centre of curvature on an opposite side of the flow path, an outside surface and an inside surface between the outside surface and the centre of curvature whereby, as the first and second substances flow through the mixer section, the second substance and particles present in the first substance migrate through the first substance, first in one direction relative to a general flow direction and then in a substantially opposite direction to promote interphasic interaction, the flow path characterised in being provided with an edge formation in a region between said adjacent stages so as to enhance launch of the second substance on the outside surface of the curved flow path section of said at least one stage towards the outside surface of the oppositely curved flow path section of the immediately adjacent stage, thus increasing the interphasic interaction.
2. Equipment as claimed in claim 1 wherein the first substance is a gas and the second substance is a scrubbing fluid.

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3. Equipment as claimed in claim 2 wherein the edge formation is stepped, with a substantially perpendicular face relative to the edge formation to enhance the launch of the scrubbing fluid.
- 5 4. Equipment as claimed in claim 3 wherein the stepped edge formation is provided with a ledge subsequent to the step to define a first and a second step, the first and the second step being arranged so as to encourage a small back eddy of gas immediately beneath the first step that deflects any downwards dribble of scrubbing fluid around the stepped edge back up into an underside of the main fluid flow as it
- 10 leaves the first step so as to enhance the contact between the launched fluid and the gas.
5. Equipment as claimed in claim 4 wherein the edge formation defines a fillet radius between the perpendicular face and the ledge to ensure maximum effect from the
- 15 back eddy.
6. Equipment as claimed in claim 4 or claim 5 wherein the length of the perpendicular face is similar to the length of the ledge.
- 20 7. Equipment as claimed in any one of claims 1 to 6 wherein the mixer comprises a plurality of adjacent stages with oppositely curved flow path sections and wherein an edge formation is provided between each of such adjacent stages.
8. Equipment as claimed in claim 7 wherein the flow path is configured and
- 25 dimensioned to orientate both the angle and the position of each launch with respect to the subsequent shape of the flow profile and to the controlled change

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39. Equipment as claimed in claim 38 wherein the annular gap is configured and dimensioned to pass debris that could access the equipment and wider than the typical maximum splash and spray layer that would accompany the scrubbing fluid as it runs down the inner walls of the cyclonic section.
- 5
40. Equipment as claimed in claim 33 wherein the gap is configured and dimensioned so that the minimum width of the annular gap at the vortex finder is based on the concept of capturing all the splash and spray into this annular area.
- 10
41. Equipment as claimed in claim 33 wherein the mixer section, the spinner section and the cyclonic section are cast in a single, substantially integral unit.
- 15
42. A method for the removal of at least one of relatively fine particulates and components from a first substance, using a second substance, the method including the steps of transporting the first substance and the second substance through a plurality of stages defining a flow path, at least one of the stages being shaped to define a substantially curved flow path section having an effective centre of curvature located to one side of the flow path, an outside surface and an inside surface between the outside surface and the centre of curvature; at least one immediately adjacent stage being shaped to define an oppositely curved flow path section having a centre of curvature on an opposite side of the flow path, an outside surface and an inside surface between the outside surface and the centre of curvature, whereby as the first substance and the second substance flow through the flow path the second
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substance and particles present in the first substance migrate through the first substance, first in one direction and then in a substantially opposite direction to promote interphasic interaction; and utilizing a launch formation between the adjacent stages for launching the second substance on the outside surface  
5 of the curved flow path section of the at least one stage to the outside surface of the curved flow path section of the immediately adjacent stage, to increase the interphasic interaction.

43. A method as claimed in claim 42 wherein the first substance is a gas and the  
10 second substance is a scrubbing fluid.

44. A method as claimed in claim 42 characterized in achieving removal efficiencies of above 90% of particle sizes of less than 0.05 micron.

15 45. A method as claimed in claim 43 characterized in being suitable for scrubbing waste gas from a modern high-performance Sinter Plant, using a suitable scrubbing fluid.

46. A method as claimed in claim 43 including the step of adding a relatively fine  
20 dust upstream of the mixer section to enhance the removal of vapours in the gas.

47. A method as claimed in claim 46 wherein the fine dust is pre-selected so as to enhance the chemisorbtion on to the dust of gasses and vapours selected from  
25 the group consisting of dibenzo furan, PCB, related compounds and any combinations thereof.

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48. A plastics composite material comprising a resin and a plurality of silicon carbide (SiC) particles embedded in the resin, the particles being bonded to the resin using a silane based bonding mechanism and the particles falling into at least first and second separate and distinct size groups and wherein the particles of the first size group are dimensionally at least 7.5 times larger than the particles of the second size group.
49. A process for producing a composite material, the process comprising the steps of:
- i. providing at least first and second separate and distinct size groups of particles of silicon carbide (SiC), the particles of the first size group being dimensionally at least 7.5 times larger than the particles of the second size group;
  - ii. pre-treating the particles with a silane solution; and
  - iii. mixing and bonding the pre-treated particles with a resin, thereby to form an abrasion, impact and temperature resistant composite mixture.
50. A process as claimed in claim 49 wherein a third separate and distinct size group of particles of silicon carbide is provided and wherein particles of the second size group are larger than the particles of the third size group.
51. A process as claimed in any of claims 49 to 50 wherein the size groups of particles are provided separately.

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52. A process as claimed in any of claims 49 to 51 wherein an amount of silane used in said solution for the pre-treatment of the particles within each size group is selected so as to substantially maximise the strength properties of the composite relative to that which can be ultimately achieved using silane pre-treatment and that specific formulation of solids and resin.
53. A process as claimed in any of claims 50 to 52 wherein a ratio of dimensional sizes between particles of the second size group and particles of the third size group is in excess of 8:1.
54. A process as claimed in any of claims 49 to 53 wherein the particles of the first size group and the particles of the second size group are provided by particles with a designated size of 10 mesh and 60 mesh respectively.
55. A process as claimed in any one of claims 49 to 54 wherein the resin is selected from a group consisting of: a vinyl ester resin, a polyurethane resin, and a combination of a vinyl ester resin and a polyurethane resin.
56. A process as claimed in any one of claims 49 to 55 which comprises the step of adding hollow or sponge-like fine particles to the composite mixture, so as to impart elasticity and sponginess to the material.

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57. A process as claimed in claim 56 wherein said fine particles are selected from a group consisting of: hollow glass spheres, hollow or sponge like kaolin particles, and a combination thereof.

5 58. A material that is produced by a process according to any one of claims 49 to 57.

10 59. Equipment for use in the removal of at least one of relatively fine particles and components from a first substance, using a second substance, the equipment comprising:

- a mixer section;
- a spinner section
- a cyclonic section;
- a vortex finder, and
- 15 - an outlet section for the second substance,

wherein at least part of at least one of the mixer section, the spinner section, the cyclonic section, the vortex finder and the outlet section is made of a material as claimed in any of claims 48 and 58.

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